

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	Gurivireddy, et al.	Docket:	135920
Serial No.:	10/056,960	Art Unit:	2616
Filed:	January 25, 2002	Examiner:	Steven H. D. Nguyen
Title:	Network Paging System and Method		

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**DECLARATION UNDER 37 C.F.R. §1.131**

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I, Sridhar Gurivireddy, do declare and say:

1. I am currently employed by Google.
2. The present invention was described in an Invention Disclosure Form (Exhibit A), submitted by me as an inventor to the Alcatel Intellectual Property Department on or about August 10, 2001 while I was a co-op with Alcatel. The Invention Disclosure Form reflects a preparation date of August 6, 2001.
3. In due course of business within Alcatel USA, the Invention Disclosure Form was submitted to Patent Committee, and a decision was made to prepare and file a utility patent application.
4. Preparation of the utility application was completed and the application was filed on January 25, 2002.

I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that all these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code.

Date: 11/30/06

  
Sridhar Gurivireddy

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Title:	Network Paging System and Method		

DECLARATION UNDER 37 C.F.R. §1.131

I, Xiaofeng Xu, do declare and say:

1. I am currently employed by Alcatel.
2. The present invention was described in an Invention Disclosure Form (Exhibit A), submitted by me as an inventor to the Alcatel Intellectual Property Department on or about August 10, 2001. The Invention Disclosure Form reflects a preparation date of August 6, 2001.
3. In due course of business within Alcatel USA, the Invention Disclosure Form was submitted to Patent Committee, and a decision was made to prepare and file a utility patent application.
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Date:

11/6/2006

  
Xiaofeng Xu

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Filed:	January 25, 2002	Examiner:	Steven H. D. Nguyen
Title:	Network Paging System and Method		

DECLARATION UNDER 37 C.F.R. §1.131

I, Vinod Choyi, do declare and say:

1. I am currently employed by Alcatel.
2. The present invention was described in an Invention Disclosure Form (Exhibit A), submitted by me as an inventor to the Alcatel Intellectual Property Department on or about August 10, 2001. The Invention Disclosure Form reflects a preparation date of August 6, 2001.
3. In due course of business within Alcatel USA, the Invention Disclosure Form was submitted to Patent Committee, and a decision was made to prepare and file a utility patent application.
4. Preparation of the utility application was completed and the application was filed on January 25, 2002.

I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that all these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code.

Date: Nov. 13<sup>th</sup>, 2006

  
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Vinod Choyi

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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<b>Title:</b>	Network Paging System and Method		

**DECLARATION UNDER 37 C.F.R. §1.131**

I, Behcet Sarikaya, do declare and say:

1. I am currently employed by Huawei Technologies.
2. The present invention was described in an Invention Disclosure Form (Exhibit A), submitted by me as an inventor to the Alcatel Intellectual Property Department on or about August 10, 2001 while I was an Alcatel employee. The Invention Disclosure Form reflects a preparation date of August 6, 2001.
3. In due course of business within Alcatel USA, the Invention Disclosure Form was submitted to Patent Committee, and a decision was made to prepare and file a utility patent application.
4. Preparation of the utility application was completed and the application was filed on January 25, 2002.

I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that all these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code.

Date: Nov. 11, 2006

B. Sarikaya  
Behcet Sarikaya

**EXHIBIT "A"**

**EXHIBIT "A"**

Local Docket No. 1370-00Alcatel Reference No. 135920

## ALCATEL USA INVENTION DISCLOSURE FORM

Please e-mail a **soft copy** of this Form to Jerri Pearson at [jerri.pearson@usa.alcatel.com](mailto:jerri.pearson@usa.alcatel.com) and send a **signed paper copy** to Jerri (972 477-9128, Alcanet 2867-9128) at M/S LEGL2. This Form is available on the Alcatel USA Intranet Legal Department site.

Invention Title: Layer-2 Triggers In Wireless Networks

Inventors:

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**FIT (Fiche D'Information Technique)**  
**TECHNICAL INFORMATION SHEET**  
Alcatel USA Invention Disclosure Form

**Title:** Layer-2 triggers for paging in wireless networks

**Author(s) of this FIT:** Sridhar Gurivireddy, Behcet Sarikaya, Vinod Kumar Choyi **Date:** 08/06/2001

**Originating Business Division/Unit:** Network Strategy Group

**Other Affected Business Divisions:** ESD, IND and SRD

**1. What is the technical problem that was to be solved?**

Mobile IP defines a protocol that allows transparent routing of IP datagrams sent by a Correspondent Node (CN) (any node that wants to communicate with a Mobile Node) to a Mobile Node (MN) in the Internet. The main problems hindering the deployment of Mobile IP are the latencies involved in configuring network layer during events like handoff and paging. These latencies can be reduced if the link layer (layer-2) provides timely information to network layer (layer-3) about the progress of events in layer-2. This document defines triggers related to "paging" that need to be fired by layer-2 for gracefully bringing down layer-3 configuration and for fast reconfiguration of layer-3 after the MN comes out of idle mode.

**2. What were the best existing solutions (known to the inventor)?**

To the author's best knowledge, no existing documents/proposals defined paging triggers. Triggers related to handoff were discussed in some earlier Internet drafts (Reference: <http://www.ietf.org/internet-drafts/draft-manyfolks-l2-mobilereq-00.txt>). But, the motivations behind defining paging triggers and handoff triggers are different. Layer-3 handover and context transfer protocols use handoff triggers to reduce latency in configuring a new interface for the mobile node at the new access point. Paging triggers can be used by layer-3 to gracefully bring down layer-3 interface for MN when mobile node switches to idle mode. Layer-3 can also use these triggers to prepare for configuring layer-3 interface when mobile node comes out of idle mode.

**3. Why were these existing solutions not good enough?**

There are no existing proposals, which define triggers for paging.

**4. What is the basic idea of the new solution described here? (Please make clear how this is different from the existing solutions)**

The events in layer-2 are notified to upper layers through triggers. This document identifies triggers related to paging. This document doesn't discuss the ways of implementation of paging triggers. Typically, they may be implemented by callback functions (or) interrupts (or) an application layer protocol. Whenever the mobile node decides to enter sleep mode (dormant mode) (or) whenever the MN is a paged, layer 2 can pass the information to layer 3 using triggers. Layer 3 can use this information to prepare for disconnection from existing layer-3 interface (or) to prepare for configuring a new layer-3 interface as soon as MN comes out of idle mode.

### 5. Description of the solution

The format used for defining triggers is same as the one used in an earlier IETF draft (Reference: <http://www.ietf.org/internet-drafts/draft-manyfolks-l2-mobilereg-00.txt>). Triggers that are identified to be useful for paging are:

L2 trigger	When	To	Parameters
MN powered	As soon as MN has been powered or has been charged i.e. (Power crosses some threshold level)	MN	None
MN low power	Battery of mobile node is low and may get disconnected	MN	None

These triggers can be used in variety of ways. For example, as soon as MN is powered on, Layer-3 can check if it's connected to a new Layer-3 interface and perform registration, if needed. "MN low power" can be used by layer-3 to anticipate future disconnection from network and can do some housekeeping operations.

L2 trigger	When	To	Parameters
MN paged	As soon as MN gets layer-2 paging request	MN	Paged L2 address, Paging agent request L2 Address
New Paging area	As soon as layer-2 paging area changes new mode	MN	New Paging area L2 address
New Paging mode	As soon as MN changes its mode (active/ dormant /inactive)	MN	New mode
Start of L2 Paging request	As soon as L2 paging of MN starts	All ARs in whose area, paging is done	MN's L2 address
End of L2 Paging request	As soon as MN responds to paging request	All ARs in whose area, Paging is done	MN L2 address

These triggers can be defined in the form of an API. The remaining part of this section defines API.



### 5.1. Basic structures used in API:

Triggers are defined as callback functions. Applications register with these callback functions which in turn notify as soon as layer-2 trigger is fired. The trigger functions are blocking, in the sense the applications are blocked at the point they call these trigger API, until the trigger is fired.

API assumes that characters are 8-bit wide and integers are 16-bit wide. Characters follow ASCII format. All the strings (or) array of characters used in API are standard null terminated 'C' strings. We used callbacks to define API. A library of callbacks can be defined, each representing one function of Layer-2 API. Concurrency in processing these triggers can easily be provided by using threads or processes. The data types of structure elements given in this draft are intended to be examples, not strict requirements.

#### 5.1.1. Format of data types

Primitive data types, used in this document, follow the POSIX format. E.g. uintN\_t means an unsigned integer of exactly 'N' bits.

#### 5.1.2 IPv6/IPv4 Address [3]

This data structure contains an array of sixteen 8-bit elements, which make up one 128-bit ipv6 address. IPv6 address is stored in network byte order.

For IPv6, layer-3 address is defined as

```
struct in6_addr{
uint8_t s6_addr[16];
};
```

For IPv4, layer-3 address is defined as

```
struct in4_addr{
uint8_t s4_addr[4];
};
```

Typecast "network\_addr" to the addressing structure, used in the system as follows:

```
#ifdef PF_INET6
typedef struct in6_addr struct network_addr;
#endif
```

```
#ifdef PF_INET4
typedef struct in4_addr struct network_addr;
#endif
```

#### 5.1.3 Layer-2 address and paging area ID

This structure assumes that the size of layer-2 address is 64 bits [EUI-64]. If a specific L2 has a different size it should be defined accordingly.

```
struct l2_addr{
uint8_t link_addr[8];
}
```

```
typedef uint8 paging_area_ID;
```

API assumes that paging area ID is of size 64 bits. If the size of paging area ID is different, it should be changed accordingly.

#### 5.1.4. Return codes

A list of error codes, which may be returned by callbacks

```
typedef enum
{
    L2_TRIGGER_RETURN=0,
    L2_TRIGGER_ERR_NOT_DEFINED,
    L2_TRIGGER_ERR_SECURITY,
    L2_TRIGGER_ERR_NOT_SUPPORTED,
    L2_TRIGGER_ERR_CANNOT_REGISTER_HERE,
    L2_TRIGGER_ERR_TIMED_OUT,
    L2_TRIGGER_ERR_ALREADY_REGISTERED,
} L2APIReturnCode;
```

The following is a description of the reasons when the error codes are returned.

##### Explanation of return codes

5.1.4.1 L2\_TRIGGER\_RETURN: This code is returned if the trigger is successfully caught.

5.1.4.2 L2\_TRIGGER\_ERR\_NOT\_DEFINED: This code is returned when a function tries to register an undefined callback.

5.1.4.3. L2\_TRIGGER\_ERR\_SECURITY: This error is returned, if L2 prevents L3 from catching the trigger for security reasons

5.1.4.4. L2\_ERR\_NOT\_SUPPORTED: This error code is returned when L3 tries to register a well-defined trigger, which is not supported by the underlying L2.

5.1.4.5. L2\_TRIGGER\_ERR\_CANNOT\_REGISTER\_HERE: This error code is returned if the callback of trigger is not allowed at the place, this function was called.

5.1.4.6. L2\_TRIGGER\_TIMED\_OUT: This error code is returned, if the trigger did not occur for certain amount of time after the callback was registered. L2 does not remember this callback any more.

5.7. L2\_TRIGGER\_ALREADY\_REGISTERED: This error code is returned if an application has already registered this callback and if the same callback cannot be registered by two or more applications.

#### 5.2.Paging API:

##### 5.2.1. MN paged

This trigger MUST be sent to MN as soon as it gets a paging request. The access point from which it received the address and the ID of the paging area are the parameters of the trigger.

```
void catch_trigger_MN_paged(L2_address*, paging_area_ID*, L2APIReturnCode* code);
```

**5.2.2. New paging area**

This trigger MUST be sent to layer-3 as soon as MN finds that it has changed layer-2 paging area. New paging area ID is sent as parameter.

Paging\_\_Area\_\_ID new\_paging\_area(L2APIReturnCode\* code);

**5.2.3. New paging mode**

Layer-3 MUST be informed by layer-2 whenever it changes its mode. (Dormant/Active/Inactive)

int new\_paging\_mode\_trigger(L2APIReturnCode\* code);

The return values of the function are

0 for dormant mode

1 for Active mode

2 for inactive mode

**5.2.4. Start of paging request**

This trigger should be sent to layer-3 in all subnets within the paging area. All the access routers need not be informed at the same time.

L2\_address paging\_request\_start(L2APIReturnCode\* code);